

**APPENDIX VII**

Serial No.: 09/955,064

Docket No.: 49933US031

---

Supplemental Preliminary Amendment filed with U.S. Patent and Trademark  
Office on September 18, 2001.

---

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s):	HOOPMAN et al.	)	Group Art Unit:	1722
		)		
Serial No.:	09/520,032	)	Examiner:	J. Leyson
Confirmation No.:	Unknown	)		
		)		
Filed:	6 March 2000	)		
For:	TOOLS TO MANUFACTURE ABRASIVE ARTICLES			

**SUPPLEMENTAL PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Attn: Examiner J. Leyson  
Washington, D.C. 20231

Dear Sir:

Prior to taking up the above-identified application for examination, please amend the application as follows:

**In the Claims**

Please cancel claims 55-87 and amend claims 17, 19-21, 25-27, 33-54, 94-96, and 98-111. Please add the following method claims 133-175. The new and amended claims are provided below in clean form. Per 37 C.F.R. §1.121, amended claims are also shown in Appendix A with notations to indicate changes made (for convenience, all pending claims, including those added hereby, are provided in Appendix A).

17. (TWICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having

specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein said three-dimensional cavities comprise pyramidal shapes, wherein each pyramidal shape comprises planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, and wherein said material-included angle is a value from 25° to 90°.

19. (TWICE AMENDED) A production tool useful to shape an abrasive slurry into an array of three-dimensional nonidentical abrasive composites, said production tool manufactured by a method comprising:

(A) preparing a master tool, the method comprising:

(1) determining angles corresponding to facing right and left planar surfaces of adjacent three-dimensional shapes and wherein each of said angles has a value as measured between its planar surface and a plane which extends in a normal direction to said major surface and contains an edge of said planar surface in contact with said major surface, by the following substeps:

(i) selecting an angle value between, but not including, 0° and 90° to establish a first right half angle of a first right planar surface of a first right-side three-dimensional shape with a random number generating means capable of randomly selecting an angle value

---

between, but not including,  $0^\circ$  and  $90^\circ$ ;

(ii) selecting an angle value between, but not including,  $0^\circ$  and  $90^\circ$  with said random number generating means to establish a first left half angle for a first left planar surface of a first left-side three-dimensional shape facing said first right planar surface of said first right-side three-dimensional shape;

(iii) proceeding along a first direction extending linearly within said first imaginary plane to a second left planar surface of a second left-side three-dimensional shape located adjacent said first left-side three-dimensional shape and using said random number generating means to select a value between, but not including,  $0^\circ$  and  $90^\circ$  to establish a second left planar angle for said second left planar surface;

(iv) using said random number generating means to select a value between, but not including,  $0^\circ$  and  $90^\circ$  for a second right planar surface of a second right-side three-dimensional shape facing said second left planar surface;

(v) proceeding along said first direction to a third right-side three-dimensional shape located adjacent said second right-side three-dimensional shape;

(vi) repeating said substeps (i), (ii), (iii), (iv), and (v), in that sequence, at least once;

(2) repeating step (1) except that the angles are determined for left and right planar surfaces of adjacent three-dimensional shapes deployed in two adjacent rows in a second direction extending linearly within said first imaginary plane, wherein said first and second directions intersect;

(3) using means to determine, for a given width of said surface of said master tool, locations of grooves required to be cut by a cutting means to form a series of intersecting grooves defining a plurality of three-dimensional shapes having said angles calculated by steps (1) and (2); and

(4) providing a cutting means to cut grooves in said surface of said master tool in correspondence to said angles calculated by steps (1) and (2) and said groove locations determined by step (3) to form a series of intersecting grooves which define a plurality of three-dimensional shapes upraised from said surface, each of said shapes being defined by a distinct and discernible

boundary including specific dimensions, wherein not all said three-dimensional shapes are identical;  
and

(B) forming the production tool using the master tool.

20. (TWICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, and wherein the production tool is a roll.

21. (TWICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible

boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, and wherein the production tool is a coating roll.

25. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

26. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

---

27. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

33. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is a coating roll.

34. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is a coating roll.

35. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least

---

one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is a coating roll.

36. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

37. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

38. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

39. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

40. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,

---



wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is a coating roll.

41. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is a coating roll.

42. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is a coating roll.

43. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is a coating roll.

44. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is an engraved metal roll.

---

45. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is an engraved metal roll.
46. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is an engraved metal roll.
47. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.
-

48. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

49. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

50. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

51. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is an engraved metal roll.

52. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is an engraved metal roll.

53. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of

cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is an engraved metal roll.

54. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is an engraved metal roll.

94. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

95. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

96. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

98. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a

---

first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is a coating roll.

99. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is a coating roll.

100. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of

---

the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is a coating roll.

101. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

102. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

103. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

104. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different between the two cavities, and wherein the production tool is a coating roll.

105. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a

first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

106. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

107. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of

the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

108. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

109. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

110. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

111. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different between the two cavities, and wherein the production tool is an engraved metal roll.

---



133. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and

forming the production tool using the design.

134. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and

forming the production tool using the design.

135. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and

forming the production tool using the design.

136. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, and further wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and

forming the production tool using the design.

---

137. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is a coating roll; and forming the production tool using the design.

138. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is a coating roll; and forming the production tool using the design.

139. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least

one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is a coating roll; and

forming the production tool using the design.

140. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and forming the production tool using the design.

141. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and forming the production tool using the design.

142. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and forming the production tool using the design.

---

143. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and forming the production tool using the design.

144. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is a coating roll; and forming the production tool using the design.

145. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is a coating roll; and forming the production tool using the design.

146. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is a coating roll; and forming the production tool using the design.

---

147. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is a coating roll; and

forming the production tool using the design.

148. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

149. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of

angles, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

150. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

151. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

152. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production

---

tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

153. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

154. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

155. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

---

156. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

157. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

158. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

159. (NEW) A methods of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair; and



forming the production tool using the design.

160. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair; and

forming the production tool using the design.

161. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair; and

forming the production tool using the design.

162. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is a coating roll; and

forming the production tool using the design.

---

163. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production

tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

164. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, and wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the  
production tool is a coating roll; and

forming the production tool using the design.

165. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and

forming the production tool using the design.

166. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and

forming the production tool using the design.

167. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and

forming the production tool using the design.

168. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one

base edge length different between the two cavities, and wherein the production tool is a coating roll;  
and

forming the production tool using the design.

169. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

170. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

---

171. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

172. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

173. (NEW) A method of making a production tool, the method comprising:

~~creating a design for a production tool for manufacturing an abrasive article, the production~~

---

tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

174. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

175. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different between the two cavities, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

---

### Remarks

As a result of the Preliminary Amendment, filed 24 August 2001, the cancelled claims were claims 1-16, 18, 22-24, 29-32, 88-93, 97, and 112-132, and the pending claims were claims 17, 19-21, 25-28, 33-87, 94-96, and 98-111. The Appendix attached to the Preliminary Amendment, filed on 24 August 2001, inadvertently listed claims 25-28 and 55-87 as being cancelled, although they had not been.

As a result of this Supplemental Preliminary Amendment, claims 55-87 having been cancelled, claims 17, 19-21, 25-27, 33-54, 94-96, and 98-11 having been amended, and claims 133-175 having been added, the pending claims are 17, 19-21, 25-28, 33-54, 94-96, 98-111, and 133-175.

Claims 17, 20, 21, 33-54, and 96-11 have been rewritten in independent form. New claims 133-175 are method claims that correlate to the production tool claims 25-28, 33-54, 94-96, and 98-111, respectively.

It is respectfully submitted that the inventions of Groups II (production tool) and III (method of making production tool) as claimed can be readily evaluated in one search without placing undue burden on the Examiner. That is, all the claims are so interrelated that a search of one group of claims will reveal art to the others. Furthermore, the method claims should be rejoined with the product claims in view of the U.S. Patent Office procedure implementing In re Ochiai in view of the fact that the method claims include all of the limitations of the production tool claims, which should be allowable.

### Examiner Interview Summary Record

Applicants' Representatives, Ann Mueting and Greg Allen, thank the Examiner for the courtesies extended during the interview on August 14, 2001. During the interview, Applicants stated that they would file a CPA and cancel all claims rejected under 35 U.S.C. §102, maintaining only the rejected claims under 35 U.S.C. §103, §112, and obviousness-type double patenting. The Examiner agreed that if these were allowable, analogous method claims would be rejoined.

---

**The 35 U.S.C. §103 Rejections**

The Examiner rejected claims 17, 25-28, and 94-96 under 35 U.S.C. §103(a) as being unpatentable over Calhoun (U.S. Patent No. 5,437,754); claims 20, 33-35, 40-46, 51-54, 98-100, 104-107, and 111 under 35 U.S.C. §103(a) as being unpatentable over Calhoun (U.S. Patent No. 5,437,754) in view of Pieper et al. (U.S. Patent No. 5,152,917); and claims 36-39, 47-50, 101-103, and 108-110 under 35 U.S.C. §103(a) as being unpatentable over Calhoun (U.S. Patent No. 5,437,754) as applied to claims 17, 25-28, and 94-96 above, and further in view of Pieper et al. (U.S. Patent No. 5,152,917).

The present application was filed on 6 March 2000 and a Continued Prosecution Application (CPA) was filed 24 August 2001. At the time of the invention of the instant application was made, the claimed invention, Calhoun (5,437,754), and Pieper et al. (5,152,917) were owned by or subject to an obligation of assignment to the same entity. The Calhoun '754 patent is a reference under 35 U.S.C. §102(e). Accordingly, Applicants' Representatives request that this rejection be removed in view of 35 U.S. C. §103(c) and notification to that effect is requested.

**Obviousness-Type Double Patenting Rejection**

Applicants' Representatives would like to point out that filing a Terminal Disclaimer (originally filed on 23 August, 2001 in connection with a Request for Continued Prosecution Application Under Rule 1.53(d)) is not an admission that it is necessary. The Terminal Disclaimer was only submitted to facilitate prosecution.



**Conclusion**

The Examiner is invited to contact Applicants' Representatives at the below-listed telephone number, if there are any questions regarding this Preliminary Amendment or if prosecution of this application may be assisted thereby.

Respectfully submitted for  
HOOPMAN et al.

By  
Muetting, Raasch & Gebhardt, P.A.  
P.O. Box 581415  
Minneapolis, MN 55458-1415  
Phone: (612)305-1220  
Facsimile: (612)305-1228  
Customer Number 26813

Sept. 18, 2001  
Date

By: Ann M. Muetting  
Ann M. Muetting  
Reg. No. 33,977  
Direct Dial (612)305-1217

---

**CERTIFICATE UNDER 37 CFR §1.8:**

The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Assistant Commissioner for Patents, Washington, D.C. 20231, on this 18th day of September, 2001, at 1:40 p.m. (Central Time).

By: Rachel Englandt Gebhardt  
Name: Rachel Englandt- Gebhardt

---

**APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS  
INCLUDING NOTATIONS TO INDICATE CHANGES MADE**

**Serial No.: 09/520,032**

**Docket No.: 49933US031**

---

Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted.

**In The Claims**

For convenience, all pending claims are shown below.

1. - 16. (CANCELLED)

17. (TWICE AMENDED) A [The] production tool [of claim 16,]for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, wherein said three-dimensional cavities comprise pyramidal shapes, wherein each [said] pyramidal shape comprises

planar surfaces which intersect to form a material-included angle at a distal end of said pyramid, and wherein said material-included angle is a value from 25° to 90°.

18. (CANCELLED)

19. (TWICE AMENDED) A production tool useful to shape an abrasive slurry into an array of three-dimensional nonidentical abrasive composites, said production tool manufactured by a method comprising:

(A) preparing a master tool, the method comprising:

(1) determining angles corresponding to facing right and left planar surfaces of adjacent three-dimensional shapes and wherein each of said angles has a value as measured between its planar surface and a plane which extends in a normal direction to said major surface and contains an edge of said planar surface in contact with said major surface, by the following substeps:

(i) selecting an angle value between, but not including, 0° and 90° to establish a first right half angle of a first right planar surface of a first right-side three-dimensional shape with a random number generating means capable of randomly selecting an angle value between, but not including, 0° and 90°;

(ii) selecting an angle value between, but not including, 0° and 90° with said random number generating means to establish a first left half angle for a first left planar surface of a first left-side three-dimensional shape facing said first right planar surface of said first right-side three-dimensional shape;

(iii) proceeding along a first direction extending linearly within said first imaginary plane to a second left planar surface of a second left-side three-dimensional shape located adjacent said first left-side three-dimensional shape and using said random number generating means to select a value between, but not including, 0° and 90° to establish a second left planar angle for said second left planar surface;

---

(iv) using said random number generating means to select a value between, but not including,  $0^{\circ}$  and  $90^{\circ}$  for a second right planar surface of a second right-side three-dimensional shape facing said second left planar surface;

(v) proceeding along said first direction to a third right-side three-dimensional shape located adjacent said second right-side three-dimensional shape;

(vi) repeating said substeps (i), (ii), (iii), (iv), and (v), in that sequence, at least once;

(2) repeating step (1) except that the angles are determined for left and right planar surfaces of adjacent three-dimensional shapes deployed in two adjacent rows in a second direction extending linearly within said first imaginary plane, wherein said first and second directions intersect;

(3) using means to determine, for a given width of said surface of said master tool, locations of grooves required to be cut by a cutting means to form a series of intersecting grooves defining a plurality of three-dimensional shapes having said angles calculated by steps (1) and (2); and

(4) providing a cutting means to cut grooves in said surface of said master tool in correspondence to said angles calculated by steps (1) and (2) and said groove locations determined by step (3) to form a series of intersecting grooves which define a plurality of three-dimensional shapes upraised from said surface, each of said shapes being defined by a distinct and discernible boundary including specific dimensions, wherein not all said three-dimensional shapes are identical; and

(B) forming [a] the production tool using the master tool.

20. (TWICE AMENDED) A [The] production tool [of claim 14 ] for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive

---

particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, [which is] and wherein the production tool is a roll.

21. (TWICE AMENDED) A production tool for manufacturing an abrasive article that comprises a major surface having deployed in fixed position thereon first and second three-dimensional abrasive composites, each of said composites comprising abrasive particles dispersed in a binder and having a shape defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein said first abrasive composite has a shape having specific first dimensions and said second abrasive composite has a second shape having second specific dimensions, wherein each of said abrasive composites has a \_\_\_\_\_

---

boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one composite meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first abrasive composite is different from all of the angles of intersection of said second composite, said production tool comprising a structure having a plurality of adjacent three-dimensional cavities form on a major surface thereof, wherein each three-dimensional cavity is defined by a substantially distinct and discernible boundary which includes substantially specific dimensions, wherein a first three-dimensional cavity has a first shape having specific first dimensions and a second three-dimensional cavity has a second shape having second specific dimensions, wherein each of said three-dimensional cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one three-dimensional cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first three-dimensional cavity is different from all angles of intersection of said second three-dimensional cavity, and wherein the production tool is a coating roll.

22. - 24. (CANCELLED)

25. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

26. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

---

27. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

28. A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, and further wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair.

29. - 32. (CANCELLED)

33. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is a coating roll.

34. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third

---

plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, [and] wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is a coating roll.

35. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, [and] wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is a coating roll.

36. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

37. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,

---



wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

38. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

39. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, [and further] wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll.

40. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, [and] wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is a coating roll.

41. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is a coating roll.

---

42. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is a coating roll.

43. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, [and further wherein] each of said cavities has a boundary defined by at least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is a coating roll.

44. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is an engraved metal roll.

45. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third

---

plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, [and] wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is an engraved metal roll.

46. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, [and] wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is an engraved metal roll.

47. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

48. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,

---

wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

49. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

50. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, [and further] wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

51. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, [and] wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is an engraved metal roll.

52. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is an engraved metal roll.

---

53. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is an engraved metal roll.

54. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, [and further wherein] each of said cavities has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is an engraved metal roll.

55. - 93. (CANCELLED)

94. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

95. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

---

96. (AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair.

97. (CANCELLED)

98. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is a coating roll.

99. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, [and] wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is a coating roll.

---

100. TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, [and] wherein at least one of the base edge lengths [one] of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is a coating roll.

101. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

102. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the ~~dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at~~

---

least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

103. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll.

104. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, [and] wherein at least two adjacent cavities have at least one base edge length[s] different between the two cavities, and wherein the production tool is a coating roll.

105. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

106. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base

---



of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, [and] wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

107. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, [and] wherein at least one of the base edge lengths [one] of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is an engraved metal roll.

---

108. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

109. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

110. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll.

111. (TWICE AMENDED) A production tool suitable for use in manufacturing an abrasive article comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, [and] wherein at least two adjacent cavities have at least one base edge length[s] different between the two cavities, and wherein the production tool is an engraved metal roll.

112. - 132. (CANCELLED)

---

133. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and  
forming the production tool using the design.

134. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and  
forming the production tool using the design.

135. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, and wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair; and  
forming the production tool using the design.

136. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, and further wherein at least 10% of pairs of adjacent cavities have at least

---

one dimension different between the two cavities of the pair; and  
forming the production tool using the design.

137. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each  
have a first geometric shape and first plurality of angles forming the geometric shape and the second  
plurality of cavities each have a second geometric shape and second plurality of angles forming the  
geometric shape, wherein at least one of the angles of the first plurality is different from all of the  
angles of the second plurality of angles, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

138. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities  
each have a first geometric shape and first plurality of angles forming the geometric shape, the  
second plurality of cavities each have a second geometric shape and second plurality of angles  
forming the geometric shape, and the third plurality of cavities each have a third geometric shape and  
third plurality of angles forming the geometric shape, wherein at least one of the angles of the first  
plurality is different from all of the angles of the second and third plurality of angles, wherein at least  
one of the angles of the second plurality is different from all of the angles of the first and third  
plurality of angles, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

139. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production

---

---

tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

140. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

141. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

---

142. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,  
wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the  
two cavities of the pair, and wherein the production tool is a coating roll; and  
forming the production tool using the design.
143. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have a geometric shape,  
dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are  
different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least  
one dimension different between the two cavities of the pair, and wherein the production tool is a  
coating roll; and  
forming the production tool using the design.
144. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have dimensions defining  
the cavity, wherein at least two adjacent cavities have at least one dimension different between the  
two cavities, and wherein the production tool is a coating roll; and  
forming the production tool using the design.
145. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production
-

tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

146. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first size and a second group of cavities has a second, different, size, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

147. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries which include substantially specific dimensions, wherein a first cavity has specific first dimensions and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at least four planar surfaces, wherein adjacent planar surfaces of one cavity meet at an edge to define an angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is different from all the angles of intersection of said second cavity, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

148. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production

---

tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape and the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second plurality of angles, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

149. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, and the third plurality of cavities each have a third geometric shape and third plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second and third plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first and third plurality of angles, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

150. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape and first plurality of angles forming the geometric shape, the second plurality of cavities each have a second geometric shape and second plurality of angles forming the geometric shape, the third plurality of cavities each have a third geometric shape and
-



third plurality of angles forming the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape and fourth plurality of angles forming the geometric shape, wherein at least one of the angles of the first plurality is different from all of the angles of the second, third, and fourth plurality of angles, wherein at least one of the angles of the second plurality is different from all of the angles of the first, third, and fourth plurality of angles, wherein at least one of the angles of the third plurality is different from all of the angles of the first, second, and fourth plurality of angles, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

151. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

152. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 30% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

153. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production

---

---

tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least 50% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

154. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have a geometric shape, dimensions defining the cavity, and angles forming the geometric shape, wherein the angles are different in at least two of the cavities, wherein at least 10% of pairs of adjacent cavities have at least one dimension different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

155. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, wherein at least two adjacent cavities have at least one dimension different between the two cavities, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

156. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities defining at least a first and a second group, wherein a first group of cavities has a first shape and a second group of cavities has a second, different, shape, and wherein the production tool is an engraved metal roll; and

---

forming the production tool using the design.

157. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities defining at least a first and a second group, wherein a first  
group of cavities has a first size and a second group of cavities has a second, different, size, and  
wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

158. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities defined by substantially distinct and discernible boundaries  
which include substantially specific dimensions, wherein a first cavity has specific first dimensions  
and a second cavity has specific second dimensions, each of said cavities has a boundary defined by at  
least four planar surfaces wherein adjacent planar surfaces of one cavity meet at an edge to define an  
angle of intersection therebetween, wherein at least one angle of intersection of said first cavity is  
different from all the angles of intersection of said second cavity, and wherein the production tool is  
an engraved metal roll; and  
forming the production tool using the design.

159. (NEW) A methods of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,  
the dimensions including base edge lengths, and wherein at least 10% of pairs of adjacent cavities  
have at least one base edge length different between the two cavities of the pair; and  
forming the production tool using the design.

---

160. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities a plurality of cavities, wherein the cavities each have  
dimensions defining the cavity, the dimensions including base edge lengths, and wherein at least 30%  
of pairs of adjacent cavities have at least one base edge length different between the two cavities of  
the pair; and  
forming the production tool using the design.
161. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity,  
the dimensions including base edge lengths, and wherein at least 50% of pairs of adjacent cavities  
have at least one base edge length different between the two cavities of the pair; and  
forming the production tool using the design.
162. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have  
a first geometric shape including a base and first plurality of base edge lengths forming the base of the  
geometric shape and the second plurality of cavities each have a second geometric shape including a  
base and second plurality of base edge lengths forming the base of the geometric shape, wherein at  
least one of the base edge lengths of the first plurality is different from all of the base edge lengths of  
the second plurality of base edge lengths, and wherein the production tool is a coating roll; and  
forming the production tool using the design.
-

163. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

164. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is

---

---

different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

165. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

166. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and  
forming the production tool using the design.

167. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at

---

least one base edge length different between the two cavities of the pair, and wherein the production tool is a coating roll; and

forming the production tool using the design.

168. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at least one base edge length different between the two cavities, and wherein the production tool is a coating roll; and

forming the production tool using the design.

169. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first and second plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape and the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and

forming the production tool using the design.

170. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production

---

tool comprising a first, second, and third plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, and the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second and third plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first and third plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and forming the production tool using the design.

171. (NEW) A method of making a production tool, the method comprising:

creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a first, second, third, and fourth plurality of cavities, wherein the first plurality of cavities each have a first geometric shape including a base and first plurality of base edge lengths forming the base of the geometric shape, the second plurality of cavities each have a second geometric shape including a base and second plurality of base edge lengths forming the base of the geometric shape, the third plurality of cavities each have a third geometric shape including a base and third plurality of base edge lengths forming the base of the geometric shape, and the fourth plurality of cavities each have a fourth geometric shape including a base and fourth plurality of base edge lengths forming the base of the geometric shape, wherein at least one of the base edge lengths of the first plurality is different from all of the base edge lengths of the second, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the second plurality is different from all of the base edge lengths of the first, third, and fourth plurality of base edge lengths, wherein at least one of the base edge lengths of the third plurality is different from all of the base

---



---

edge lengths of the first, second, and fourth plurality of base edge lengths, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

172. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 10% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

173. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 30% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and  
forming the production tool using the design.

174. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the cavity, the dimensions including base edge lengths, wherein at least 50% of pairs of adjacent cavities have at least one base edge length different between the two cavities of the pair, and wherein the production tool is an engraved metal roll; and

---

forming the production tool using the design.

175. (NEW) A method of making a production tool, the method comprising:  
creating a design for a production tool for manufacturing an abrasive article, the production  
tool comprising a plurality of cavities, wherein the cavities each have dimensions defining the  
cavity, the dimensions including base edge lengths, wherein at least two adjacent cavities have at  
least one base edge length different between the two cavities, and wherein the production tool is  
an engraved metal roll; and  
forming the production tool using the design.